

H.A

<b>Notice of Allowability</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/802,411	SON ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Asok K. Sarkar	2891	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to amendment filed 10/24/2005.
2. ☒ The allowed claim(s) is/are 1-22.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☒ All    b) ☐ Some\*    c) ☐ None    of the:
    1. ☒ Certified copies of the priority documents have been received.
    2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
  - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
    - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
  - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

- |   |  |
|---|--|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892)  | 5. <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)            |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 6. <input type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date _____. |
| 3. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08),<br>Paper No./Mail Date <u>9/22/05</u> | 7. <input type="checkbox"/> Examiner's Amendment/Comment                               |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br>of Biological Material                              | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance   |
|   | 9. <input type="checkbox"/> Other _____.   |

## **DETAILED ACTION**

### ***Response to Amendment***

1. Applicant's explanation of the instant invention in pointing the difference with the cited prior art was persuasive.

### ***Allowable Subject Matter***

2. Claims 1 – 22 are now allowed.
3. The following is an examiner's statement of reasons for allowance:

Claims 1 – 7 and 21 recite, inter alia, a method for filling a hole with metal comprising successively forming an insulating layer, a first mask layer, and a second mask layer on a semiconductor substrate, etching the first and the second mask layers to respectively form first and second masks, each of the first and second masks having a first opening that has a first width, selectively etching the first mask to form a third mask having a second opening that has a second width that is greater than the first width, etching the insulating layer using the second mask to form a hole having the first width thereby exposing a conductive material at the bottom of the hole, forming a metal layer on the insulating layer to fill the hole and the second opening with the metal layer and removing the third mask and the metal layer to expose the upper surface of the insulating layer. The art of record does not disclose or anticipate the above limitation in combination with other claim elements nor would it be obvious to modify the art of record so as to form a device including the above limitation.

Claims 8 – 12 and 22 recite, inter alia, a method for filling a hole with metal comprising successively forming an insulating layer and a first mask layer on a

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semiconductor substrate, etching the first mask layer to form a first mask having a first opening that has a first width, etching the insulating layer using the first mask to form a hole having the first width, etching the first mask to form a second mask having a second opening that has a second width that is greater than the first width, forming a metal layer on the insulating layer to fill the hole and the second opening and removing the second mask and the metal layer to expose the upper surface of the insulating layer. The art of record does not disclose or anticipate the above limitation in combination with other claim elements nor would it be obvious to modify the art of record so as to form a device including the above limitation.

Claims 13 – 19 recite, inter alia, a method for filling a hole with metal comprising forming an insulating layer on a semiconductor substrate, successively forming first and second mask layers on the insulating layer, forming a photoresist pattern on the second mask layer, etching the first and second mask layers using the photoresist pattern as a mask to form a first mask having a first opening that has a first width and a second mask having a second opening that has the first width, etching the first mask using an etchant, the first mask having a higher etching selectivity with respect to the etchant than the second mask, to form a third mask having a third opening that has a second width that is greater than the first width, etching the insulating layer using the second mask to form a hole having the first width, forming a metal layer on the insulating layer to fill the hole and the third opening and removing the third mask and the metal layer to expose the upper surface of the insulating layer. The art of record does not disclose or

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anticipate the above limitation in combination with other claim elements nor would it be obvious to modify the art of record so as to form a device including the above limitation.

Claim 20 recites, inter alia, a method for filling a hole with metal comprising successively forming an insulating layer and a mask layer on the semiconductor substrate, forming a first photoresist pattern on the mask layer, etching the mask layer using the first photoresist pattern as a mask to simultaneously form an insulating layer pattern having a hole that has a first width and a first mask having a first opening that has the first width, forming a second photoresist pattern having a pattern width greater than the first width on the first mask, etching the first mask using the second photoresist pattern as a mask for exposing an upper surface of the insulating layer pattern to form a second mask having a second opening that has a second width greater than the first width, forming a metal layer on the insulating layer to fill the hole and the second opening and removing the second mask and the metal layer to expose the upper surface of the insulating layer. The art of record does not disclose or anticipate the above limitation in combination with other claim elements nor would it be obvious to modify the art of record so as to form a device including the above limitation.

### ***Conclusion***

4. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

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5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is 571 272 1970. The examiner can normally be reached on Monday - Friday (8 AM- 5 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William B. Baumeister can be reached on 571 272 1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

6. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Asok K. Sarkar  
November 15, 2005

Primary Examiner